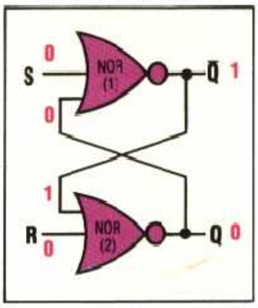
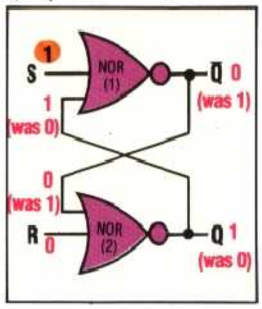
1) Initial State (RESET)

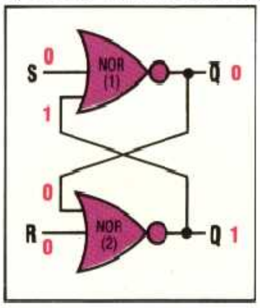


2) A pulse On The SET Line

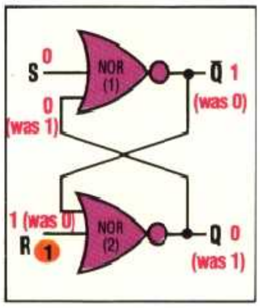


Even when the pulse is removed from the S line the circuit continues in a stable state. When a pulse is sent along the R line, the circuit is again put into an unstable state. After a similar process to that already described, the circuit again settles down to a stable RESET state.

3) Circuit Remains Stable (SET)

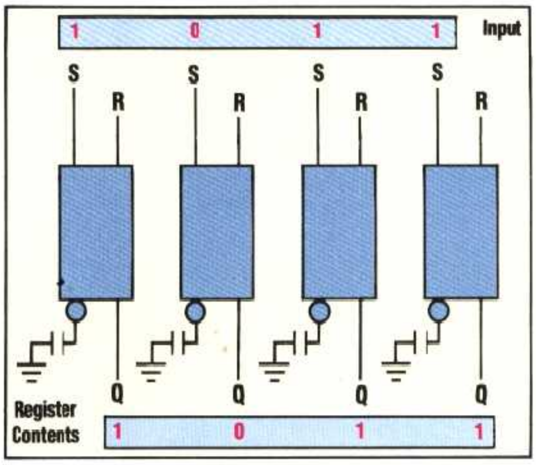


4) A Pulse On The RESET Line



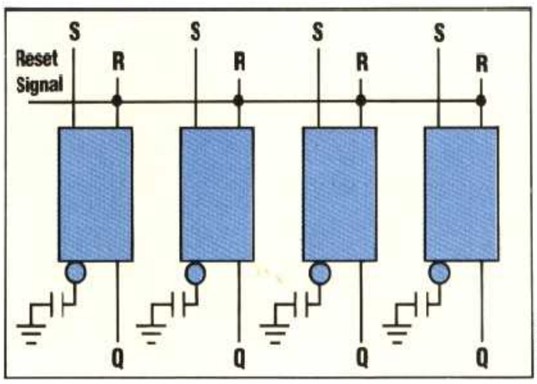
REGISTERS

The microprocessor of your home computer is largely made up of a series of registers, such as the accumulator, instruction and index registers. Most registers can hold eight-bit words — that is, binary numbers in the range 0 to 255. As these registers have to accept and remember binary information it is not surprising that they are made up of a series of eight flip-flops. To simplify matters, we will here look at how a four-bit register accepts and stores numbers. If we wish to store the binary number 1011 in the register then all that is required is for the binary pattern to be fed to the S lines.



Notice that in this arrangement the 'not Q' output is unused. As the binary input pattern is applied to the S lines of the flip-flops, so the Q lines produce a corresponding output. If we wished to overwrite the first number stored in the register with another, say 0110, we may think that all we need to do is present this new binary pattern to the S lines of the flip-flop. In fact, if we did this the resulting number stored in the register would be 1111. The ones in the outer positions of this number are hangovers from the previous number.

The solution to this problem is to reset each flip-flop before storing the second number. As all flip-flops need resetting at the same time, it is convenient to connect them together allowing a reset of the register to be triggered by one signal.



LIZ DIXON

In the next instalment of the course, we will look at other sequential circuits, including the D-type flip-flop and the J-K flip-flop.

Exercise 7

1) Why is a flip-flop also known as a 'bistable'?

2) Initially, when a computer is switched on, a flip-flop is in the following state:

$Q = 0, \bar{Q} = 0, S = 0, R = 0$

a) Is this a stable state?
b) If not, what state will the flip-flop change to?
c) Can the flip-flop change to a different state to that given in your last answer? (Hint: try starting with the other gate.)
d) What process is necessary, when you switch on a computer, to ensure that all the registers are in a predictable state?